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Additional submitted attachment is included below.

**Before the California Energy Commission
Docket No. 17-BSTD-01
2019 Building Energy Efficiency Standards Pre-Rulemaking**

Comments on the Draft Proposed Changes to the Requirements for Residential Fenestration Presented at the October 4-5, 2017 Staff Workshop

I am writing to offer the following comments and recommendations regarding the requirements for residential fenestration in the Draft 2019 Building Energy Efficiency Standards that were presented at the October 4-5, 2017 Pre-rulemaking Workshops. I also provided oral comments on these same issues at the October 5, 2017 Staff Workshop.¹

At the outset, let me summarize our views and recommendations on the proposed draft Standards:

- (1) We **OPPOSE** the proposed prescriptive minimum 0.35 SHGC for residential fenestration in Climate Zones 1, 3, 5, and 16. We recommend maintaining the current and historical approach to SHGC for these zones in California, specifically retaining “NR” for zones 1, 3 and 5 and retaining a maximum SHGC in zone 16 (or converting it to “NR”). We recommend that any benefits of high solar gain be promoted and captured on a case-by-case basis through the performance compliance approach under the ACM Manual. However, if a maximum SHGC is imposed, a 0.30 SHGC would be more practical and reasonable than 0.35.

- (2) We **SUPPORT** the proposed reduction of the prescriptive maximum U-factor to 0.30 and maximum SHGC to 0.23 for residential fenestration in climate zones, 2, 4, and 6 – 15.

We previously submitted written comments in this Docket on June 16, 2017 in response to the Residential High-Performance Windows & Doors CASE Study Report that analyzed potential proposed window measures. In those comments, we supported the CASE primary Proposal and recommended against the Alternative Proposal. Unfortunately, the draft Standards presented at the October 4-5 Workshops incorporate the Alternative Proposal. Our earlier written comments described numerous technical and practical reasons in support of our recommendations, and we incorporate those comments by reference here.²

¹ Our firm has participated in the development of the fenestration requirements of the Title 24 Standards for many years. We have extensive experience representing energy efficient building product manufacturers (including fenestration) and other energy efficiency interests in model and state energy code development and adoption nationwide since the 1990s, and we offer our perspective and recommendations based on this experience.

² The final CASE Study Report acknowledged a commenter making “several suggestions that could also improve upon the current modeling of ‘no requirement’ climate zones” and that it could be an “advantage” to maintain

I. Opposition to Establishing a Prescriptive Minimum SHGC

As was stated in our prior written and oral comments, we continue to strongly recommend against any proposal that would establish a prescriptive minimum SHGC requirement in climate zones 1, 3, 5 and 16. If the Standards need to be revised to attempt to better address solar gain in heating-dominated climates, we believe that the best approach would be to make changes to the Standard Design and/or the ACM Reference Manual so that the base case window for performance compliance is reset at a lower value than the current 0.50 SHGC baseline. We recommend using a 0.23 SHGC, or possibly a 0.30 SHGC, as the baseline value. Such an approach would allow users to compare the effect of higher SHGC windows against a baseline window that would be far more representative of a typical window being installed in California (and thereby rewarding high solar gain fenestration when appropriate). Any other compliance concerns could also be addressed in the ACM Manual. We have attached to these comments proposed language that would set a 0.23 SHGC baseline for the performance calculations in both the Standard Design and the ACM Reference Manual for NR climate zones. If we are required to submit a formal code change proposal for this language to be considered, please advise.

With regard to the single-family and multi-family residential prescriptive tables of requirements in the Standards, we recommend that California retain the “NR” SHGC prescriptive requirement in CZs 1, 3, and 5 (and either “NR” or a maximum 0.23 for CZ16). This has been the approach used for many years in California and in other energy codes in the United States for heating-dominated climates. We are aware of no energy code in the United States that prescribes a minimum SHGC; moreover, such proposals have been consistently and soundly rejected for the national model energy code (the International Energy Conservation Code).

Control of fenestration solar gain and resulting cooling needs is a high priority in controlling peak demand and reducing peak energy use throughout most of California. Establishing a prescriptive minimum SHGC complicates the issue unnecessarily by sending a contradictory message for some areas of the state, and in particular for CZ16, which is currently a climate zone that requires a maximum SHGC. Maintaining stability in the Standards in order to send a consistent energy efficiency message for consumers is a very important policy objective. Switching from a maximum or no SHGC requirement to a minimum SHGC is a big change and reversal of course and is very problematic and potentially confusing in both technical and public information and education contexts. While designing for solar gain benefits may be warranted in some locations

“the use of ‘no requirement’ in the prescriptive packages that has been in use for many years. The message to the energy consultants and builders that lower SHGC can increase energy use in the affected mild heating climates is diminished with this approach.” (CASE Study, Residential High Performance Windows and Doors – Final Report, August 2017, at p. 10.)

in these zones, the performance compliance method is the place to evaluate the benefits of such an approach in a specific proposed home.

In addition, we note that actual energy savings from high solar gain windows in heating climates is far from certain, which also places into question whether a prescriptive maximum SHGC is warranted. Unlike most energy efficiency features that produce more certain benefits, any benefits from high solar gain are highly dependent on occupant behavioral issues such as how shades are used (in addition to more permanent aspects like orientation, design, etc.). Occupants may very well leave the shades closed during winter days, eliminating expected solar gain, for reasons such as privacy, reduced glare and greater comfort. As a result, we do not recommend relying upon and counting any estimated savings from this requirement in calculating overall energy savings from the new Standards.

In sum, we believe that shifting from an “NR” to a minimum SHGC would result in unintended negative consequences that would outweigh any expected benefits. We elaborate further on some of these below.

a. Establishing A Prescriptive Minimum SHGC Requirement Could Generate Unexpected and Undesirable Cooling Load in Historically Heating-Dominated Climate Zones

We do not believe that we can or should try to achieve benefits from high solar gain prescriptively. True passive solar design depends first and foremost on glazing area facing the appropriate cardinal orientations, the architecture of the structure, thermal mass, and overhangs, among other things. While the performance and software calculations can take these types of factors into consideration, none of these aspects, which are needed to properly capture beneficial solar gain, is adequately captured in the proposed prescriptive minimum 0.35 SHGC requirement.

Under the 0.35 SHGC proposal, it is feasible that a home could be built with high solar gain SHGC glazing located predominately on the east, west and/or north orientations, and little or no south-facing glazing. The result of such a design would mean that there could be little or no solar gain available with the potential to beneficially offset heating load, and potentially worse, such design attributes could cause unexpected cooling load. For example, if there is a prescriptive requirement for high solar gain glazing on all orientations, including west facing orientations, combined with no glazing area limit on the amount of high solar gain glass facing west (because the prescriptive 5% maximum west-facing glazing area limitation would not apply in CZs 1, 3, 5, and 16), such a combination could cause occupant discomfort on sunny days and the need for cooling to eliminate unwanted solar gain. Clearly, such a result could have an impact in CZ16,

which has meaningful cooling load already. However, this combination could impact the coastal climate zones, as well. As it was discussed during the October workshops, many homes in coastal climate zones have heat pumps that are charged to provide air conditioning (even if not historically installed for cooling). If a homeowner in one of these zones has a heat pump and is faced with uncomfortable solar gain, it is reasonable to assume he or she will turn on the air conditioning to remedy that discomfort. Such additional cooling load would add to electric utility peak demand at just the time when it is most problematic.

b. Establishing a Prescriptive Minimum SHGC Would Unnecessarily and Unreasonably Preclude Certain Products and Cause Problems for Windows Used in Additions, Alterations and as Replacements.

Under the current Standards, in the climate zones where the SHGC requirement is “NR,” all types of low-e products are permitted by the prescriptive requirements. This is the common approach nationwide for codes and standards in these types of climate zones. In particular, high-performance, low solar gain, low-e windows may be the preferred choice for contractors and homeowners, even in heating-dominated climates, because of the lower U-factors low solar gain low-e coatings are able to achieve relative to high solar gain coatings and because of other price, comfort, and performance related benefits. However, under the 0.35 SHGC proposal, these windows would be banned outright under the prescriptive path, in many additions and alterations, and as replacement windows.

The prohibition of high performance, low solar gain, low-e glazing in certain zones prescriptively and for replacement will preclude its use as appropriate in existing homes (such as west orientations). It will also negatively impact a homeowner or contractor who buys windows from big box stores or online retailers serving multiple regions of the state that only stock low solar gain window products. In addition, a homeowner who is undertaking an addition, alteration, or partial window replacement, would now face challenges in trying to match new high solar gain windows with existing low solar gain glazing in the same home (due to differences in the appearance of the glass). As noted elsewhere, the perceived problem – support for high solar gain fenestration in certain zones – can be solved in the ACM Manual without creating these unnecessary unintended consequences.

c. Updating the Performance Baseline and the ACM Reference Manual Would Be the Better Approach.

The type of low-e coating that likely will be used to achieve a maximum 0.30 U-factor typically will produce an SHGC far lower than 0.50 or 0.35. In fact, the typical window products available throughout most of California will have U-factors at or below 0.30 and SHGCs at or below 0.23.

In this regard, reducing the SHGC for the Standard Design and in the ACM Manual from 0.50 to the proposed 0.35 represents a modest improvement in this regard and could be adopted. However, we think it would be more appropriate for the Standard Design to set an SHGC value that represents the most common windows that will be used to achieve the 0.30 U-factor requirement, which is a low solar gain, low-e window (around 0.23 SHGC). At a minimum, we suggest that the value be set no higher than 0.30, which is a reasonable line between low solar gain products and more standard low-e products (0.35 tends to cut through the middle of the standard low-e products, allowing some and not others).

II. Support for the Updated Maximum U-Factor and SHGC Prescriptive Values in the Draft Proposal

As we stated and advocated in our prior comments, we support updating the Standards to set a maximum prescriptive 0.30 U-factor for the entire state and a maximum prescriptive 0.23 SHGC for climate zones with cooling load (we would include CZ16). These proposed maximum prescriptive U-factor and SHGC values are a reasonable continuation and extension of the current requirements in the Standards and reflect the characteristics of the cost-effective high-performance window that is readily and broadly available in California at this time.

We offered a word of caution in our prior comments, which we believe is worth repeating here. Eliminating the current Standards' maximum SHGC requirement in CZ16 is debatable and potentially problematic. Such a change should be carefully considered due to potential unintended consequences. Even though the LCC TDV calculations this year may support such a change, it could cause a "yo-yo" effect for builders, homeowners, and retailers who have been educated on meeting the current Standards to understand that solar control is the appropriate measure in CZ16. Also, because CZ16 is not a coastal climate and is subject to fluctuating cooling load, it is feasible to assume that LCC TDV calculations in future cycles could flip in a manner that might warrant a maximum prescriptive SHGC requirement be reinstated in CZ16. Such a flip truly would confuse the market and may damage consumer behavior and knowledge when selecting the proper windows. For these reasons, we think that it would be a better decision for the long term to retain a maximum SHGC requirement in CZ16 for the 2019 Standards and revisit this issue if necessary in a future update.

III. Conclusion

In conclusion, we offer the following summary of our recommendations:

- (1) We strongly recommend reconsidering the draft proposal to establish a prescriptive minimum SHGC, and instead recommend reinstating "NR" as the prescriptive SHGC

requirement in CZs 1, 3, 5, and 16. If some change to the current Standards' SHGC approach is deemed necessary in these zones, we support changing the SHGC used in the Standard Design and in the ACM Reference Manual for "NR" climate zones from 0.50 to a lower number, ideally 0.23, but preferably no higher than 0.30.

- (2) We strongly support the draft proposed maximum prescriptive 0.30 U-factor across the state, and a maximum prescriptive 0.23 SHGC in Climate Zones 2, 4 and 6-15. We suggest that the proposed draft SHGC change in CZ16 be reconsidered and that consideration be given to retaining a maximum prescriptive SHGC requirement in this zone consistent with the other zones with significant cooling in California.

We thank you for the opportunity to provide these comments.

Respectfully submitted,



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ATTACHMENT

Proposed Language Changes to the Standards to Implement Our Recommendations to Address the SHGC Specified in the Standard Design and in the ACM Manual

The sections below are excerpts from the 2016 Standards and the 2016 ACM Reference Manual that we have identified for potential changes to implement our recommendation of revising the Standard Design SHGC from its current value of 0.50 to our proposed value of 0.23 (in underline/strikethrough format for changes to be added or ~~deleted~~). While we have inserted a 0.23 SHGC per our recommendations in these comments, an alternative value could be inserted if deemed appropriate (as noted above, a 0.30 SHGC in the Standard Design would be our recommended alternative if 0.23 is determined to be not acceptable).

Proposed Changes:

**SUBCHAPTER 8
LOW-RISE RESIDENTIAL BUILDINGS**

**SECTION 150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE
APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS**

* * *

4. **Shading.** Where TABLE 150.1-A or B requires a Maximum Solar Heat Gain Coefficient (SHGC), the requirements shall be met by one of the following:
- A. Complying with the required SHGC pursuant to Section 150.1(c)3A; or
 - B. An exterior operable shading louver or other exterior shading device that meets the required SHGC; or
 - C. A combination of Items A and B to achieve the same performance as achieved in Section 150.1(c)3A.
 - D. For south-facing glazing only, optimal overhangs shall be installed so that the south-facing glazing is fully shaded at solar noon on August 21 and substantially exposed to direct sunlight at solar noon on December 21.
 - E. Exterior shading devices must be permanently secured with attachments or fasteners that are not intended for removal.

EXCEPTION to Section 150.1(c)4A: Where Table 150.1-A indicates NR (no requirement) for SHGC, the SHGC shall be set at 0.23 for the Standard Design.

EXCEPTION to Section 150.1(c)4E: Where the California Building Code (CBC) requires emergency egress or where compliance would conflict with Health and Safety regulations.

RESIDENTIAL ALTERNATIVE CALCULATION METHOD REFERENCE MANUAL FOR THE 2019 BUILDING ENERGY EFFICIENCY STANDARDS

2.5 CONDITIONED ZONES

* * *

2.5.6.6 Fenestration

* * *

STANDARD DESIGN

If the proposed design fenestration area is less than 20 percent of the conditioned floor area, the standard design fenestration area is set equal to the proposed design fenestration area. Otherwise, the standard design fenestration area is set equal to 20 percent of the conditioned floor area. The standard design fenestration area is distributed equally between the four main compass points— north, east, south and west.

The standard design has no skylights.

The net wall area on each orientation is reduced by the fenestration area and door area on each facade. The U-factor and SHGC performance factors for the standard design are taken from Section 150.1(c) and Table 150.1-A (Package A). Where Package A has no requirement (NR), the SHGC is set to 0.230-50.